

ART. X.—*The Bluff at Barwon Heads.*

(With Plate XIV.)

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This bold headland, at the mouth of the River Barwon, presents some features of geological interest. A crag of grey sandstone, it owes its preservation to the circumstance that its seaward extremity stands upon a basement of hard lava, which rises just above the level of high-water. The result of such an arrangement of the rocks is illustrated by the profiles of two of the cliffs, one of which consists wholly of calcareous sandstone, the lava foundation being wanting.

Where the base is of lava, as it is in the cliff at *B* in Section *A B*, the profile has an inclination of about  $45^\circ$ , and can easily be scaled. This shows that the rate of recession of the face of the cliff is much faster than that of the foot. Now, the foot of such cliffs is cut back by both the sea and the weather, while the face is cut back by the weather alone. As the waves and weather together work into the cliff much more quickly than the unaided atmospheric agencies can, we seek for some special condition in the cliff itself, to explain the slanting profile, and we find it in the toughness of the lava base, which here retards the encroachments of the waves.

If we now turn to the cliffs near *D*, we see that one is vertical, and another, which I have not drawn, is deeply undercut at the sea level, so that it continually falls in great slabs, which encumber the beach. Here the entire face of the cliff is of homogeneous material, and the greater wasting power of the sea over the atmosphere shows itself in the profile, which is vertical where it does not overhang its foot. The aerial destruction is not less here, but the sea scour is much greater. Hence the difference between the profiles of the two cliffs.

The next circumstance illustrated by the local features is the effect of a lava flow upon the distribution of shallow water deposits.

The tongue of rock projected in a molten state across a submarine plain of shifting sands, forms a permanent ridge against which the swift currents at once heap up bars of sand. When these become very thick, so that the lower portions are not disturbed for long periods, the base of the mass may become cemented into hard rock by the percolation of lime in solution, or from the moment sand is heaped over the uncooled lava, the gases and acidulated waters may slake the mass into compact strata. This has occurred here, and thus a spit seems to have been formed, over which is spread a bed of clay which may be volcanic ash decomposed *in situ*. or an ordinary littoral deposit. Upon the top of this clay bed is a very horizontal soil bed; just such a sandy loam as is now seen to be capping the cliffs, very fine, and darkened with abundant carbonaceous matter. The next stage is that this land surface—which may have been no more than the muddy fore-shore of the Barwon, or Lake Connemara—gets covered with sand, which is false bedded, and as far as I can see, unfossiliferous. Whether then this is a sedimentary or an eolian deposit it is hard to say, as false bedding occurs in rocks originating in either way. There are, however, thin beds of water-worn conglomerates intercalated between these false bedded sandstones, which lead me to believe that the coast was sinking and that the sands were spread over this spit by the sea currents. The old land surface humus, although it has been compressed by the overlying sandstone, is still about two feet thick, and its upper margin is very sharply marked off from the deposit above it. This latter rises as a cliff face to a height of from seventy to ninety feet. It is divided into at least three greater divisions, and these again are resolvable into lesser beds, all current bedded. There are differences to be observed which distinguish the larger masses from each other. The middle bed at one part of the cliff especially, contains so much lime that every projection of the rock wall carries its group of stalactites. At a considerable height up the cliff face there is a bed of conglomerate, or breccia, marked *E* in the sections. The stones are small sized, some are basaltic pebbles water-worn, the rest are of sandstone, some rolled and some not, many having a black burnt look. The whole mass is very strongly cemented together by carbonate of lime. It is worthy of

Fig. 1.

Bass Straits.

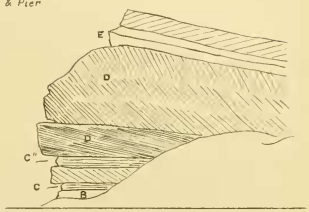
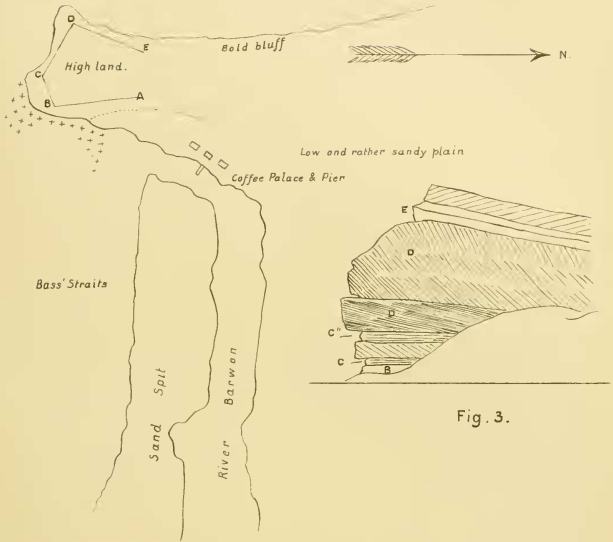


Fig. 3.

Fig 2.

